



Soft Matter

ARTICLE

Supporting Information for

Scalable and Durable Polymeric Icephobic and Hydrate-phobic Coatings

Hossein Sojoudi,^a Hadi Arabnejad,^b Asif Raiyan,^a Siamack A. Shirazi,^b Gareth H. McKinley,^{*c} and Karen K. Gleason^{*d}

^a Dept. of Mechanical, Industrial and Manufacturing Engineering, The University of Toledo

^b Dept. of Mechanical Engineering, The University of Tulsa

^c Dept. of Mechanical Engineering, MIT

^d Dept. of Chemical Engineering, MIT

Supporting material includes:

Figures S1 to S4

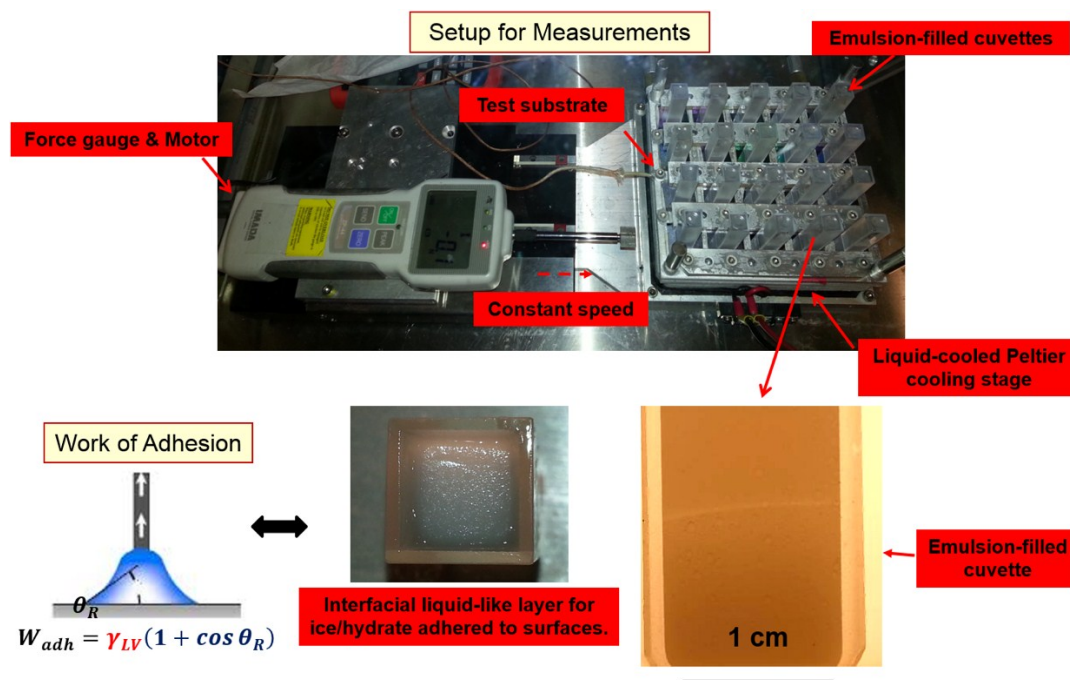


Figure S1. (Top) Photograph of the set up used for ice and hydrate adhesion measurements. Inset shows a cuvette filled with the cyclopentane hydrate and slushy hydrate inside the cuvette. Interfacial liquid-like layer of the ice/hydrate adhered to a surface helps to justify the reported correlation¹ between the work of adhesion between a liquid droplet and surface and the adhesion strength of formed solid (ice/hydrate) on the corresponding surfaces.

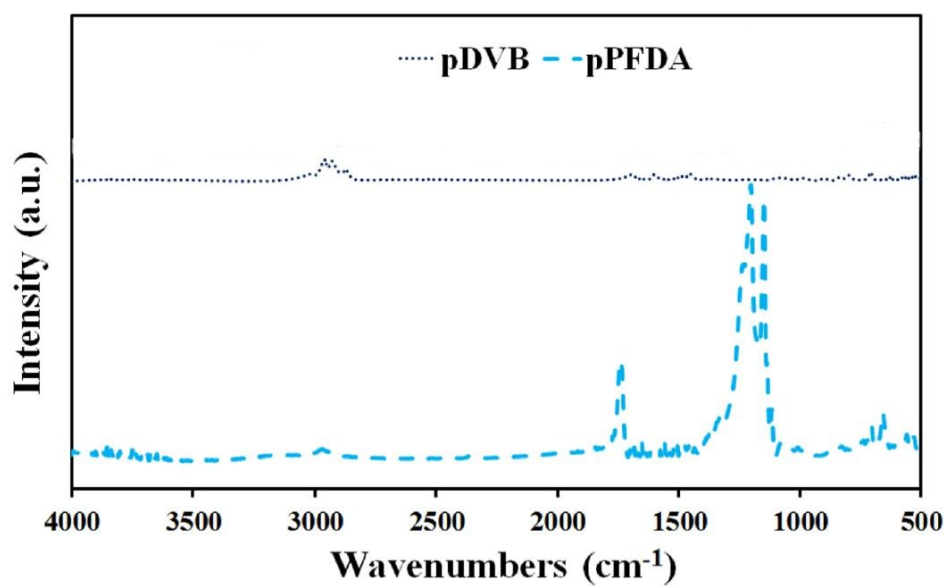


Figure S2. Polymer composition determined by Fourier Transform IR (FTIR) spectra of the pDVB and pPFDA. Presence of the bands corresponding to carbonyl (at 1741 cm^{-1}) and fluorine (at 1153 , 1207 , and 1246 cm^{-1}) in the pPFDA spectra and band corresponding to phenyl group (in the range of $700\text{--}1000\text{ cm}^{-1}$) in the pDVB spectra are indicative of successful deposition of the bilayer polymer.

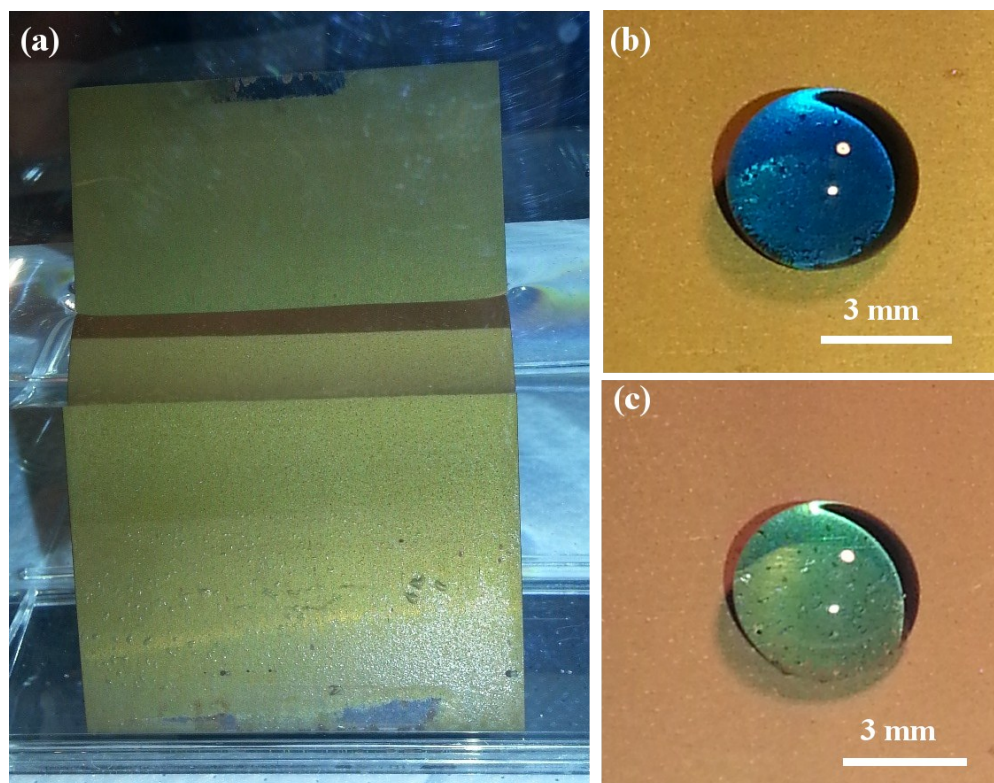


Figure S3. (a) Photograph of a grafted bilayer polymer film on steel substrates (2 inch*3 inch) after sand abrasion test, showing presence of shiny air bubbles called “plastrons”. Photographs of a water droplet (b) and a CyC5-in-water emulsion droplet (c) on the grafted bilayer samples after sand abrasion tests. These photographs show that the superhydrophobic character of the samples is maintained after the sand abrasion tests. The scale bar in (b) and (c) are 3 mm.

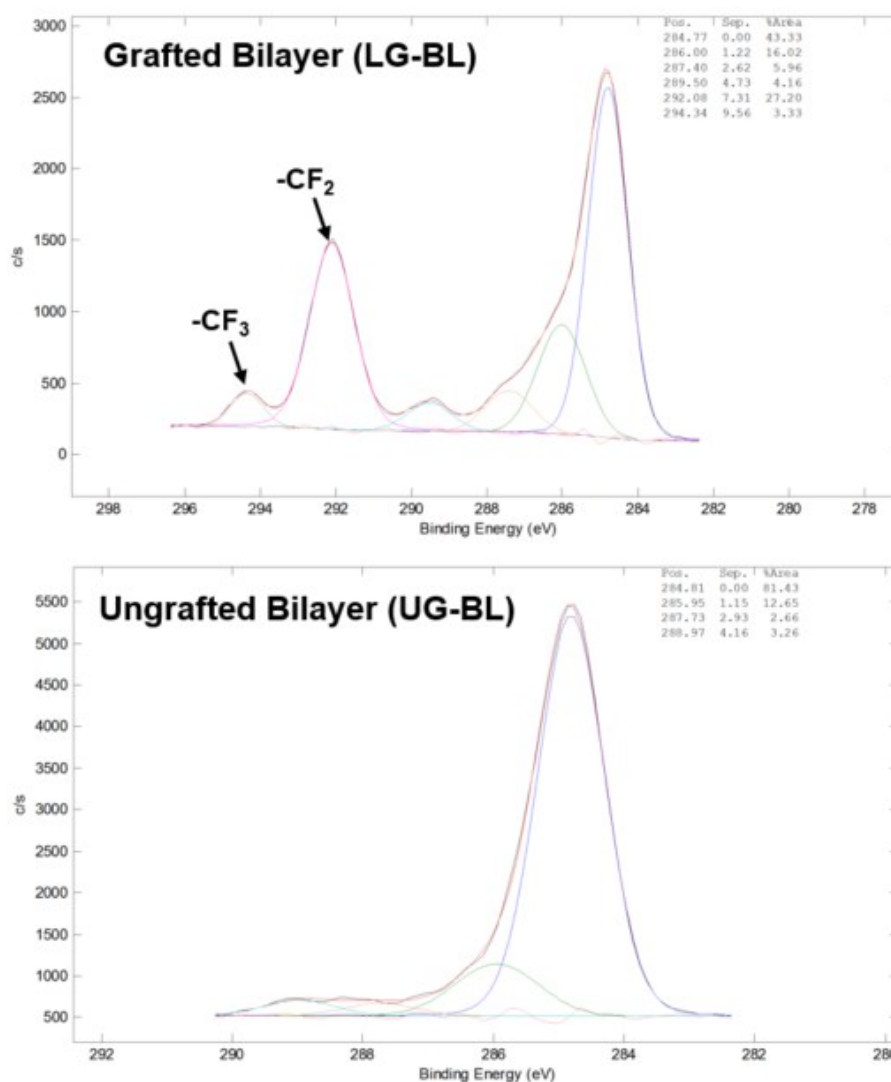


Figure S4. (Top) Core level C1s XPS spectra of the linker-grafted bilayer (LG-BL) and the ungrafted bilayer (UG-BL) after sand erosion test. Around 30% of carbon is bonded to fluorine in the grafted sample as $-\text{CF}_2$ and $-\text{CF}_3$ groups, whereas no discernable carbon bonded to fluorine can be observed in the ungrafted sample, based on the detection limit of the XPS. This confirms considerable erosion of the ungrafted sample when compared to the grafted sample due to the sand tests.

1. H. Sojoudi, M. R. Walsh, K. K. Gleason and G. H. McKinley, *Langmuir: the ACS journal of surfaces and colloids*, 2015, **31**, 6186-6196.